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BOSTON:
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1886.

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Mr. Chairman, and Gentlemen of the Committee, — The question before you is a simple one.

It is, Shall the bill recommended by the Drainage Commission of 1884 be reported by you to the Legislature?

The object of the bill is to compel the city of Worcester to purify its sewage before turning it into the Blackstone River.

The first section is as follows: —

"SECTION 1. The city of Worcester is hereby directed, within years after the passage of this Act, to purify from all offensive, noxious, and polluting properties the waters or substances that may thereafter be discharged from its sewers into Blackstone River, or any of its tributaries, so that said waters and substances shall not of themselves, or in connection with other matters, create a nuisance, or endanger the public health; and said city thereafter shall cease to empty from its sewers into Blackstone River, or any of its tributaries, any waters or substances containing said properties until the same shall have been first so purified."

It will be observed that this section is prohibitory in its character; it recognizes two evils from the discharge of unpurified sewage into the stream: first, a nuisance; and second, danger to the public health: and the distinction between these two classes of evils must be kept constantly in mind. This section is intended to provide a remedy for both, but does not impose upon the city any specific plan of operations by which it is to be accomplished: it must, then, be considered in connection with the suggestion of the engineer of the Commission, found on p. 219 of the report, that "Worcester . . . be required to purify its sewage in some way, leaving the choice of methods, and its details, to be determined by the city itself."

I cannot agree with the city solicitor in his proposition that it imposes upon the city the duty of adopting the plans of the State Board of Health in 1882. Whether the method shall be intermittent downward filtration, or broad irrigation, or chemical precipitation, or a combination of two or more of these methods, is left optional with the city; the prime object is purification: so far as the bill is concerned, the means are unimportant.

The second section of the Act gives the city ample authority to do all things necessary to be done in carrying out the purposes of the Act, and in its terms corresponds with the provisions of like nature found in all Acts conferring upon corporations, municipal or otherwise, rights analogous to that of eminent domain; and the authority given by it has practically been judicially determined by a long line of decisions, so that the extent of the authority conferred and the method of its exercise are plain.

Section 3 authorizes the city to raise and appropriate the necessary money to carry out the provisions of the Act. It is submitted that this section is an answer to the evidence offered as to the fact that Worcester has nearly reached the limit of indebtedness permitted by law. It is competent for the Legislature to order work done by a municipality involving an expenditure of money, and to authorize it to raise the necessary amount; and the effect of such legislation is to take the municipality out of the general law regulating indebtedness so far as that expenditure is concerned.

Section 4 provides a remedy in case the provisions of the bill are not complied with by the city; and it will be observed that it guards carefully the rights of the city in this, that the remedy can only be sought by the selectmen of towns upon the Blackstone River, so that there is no danger to apprehend hasty and inconsiderate and hostile action by individuals whose private rights may suffer; and in general it recognizes the proposition that it is a matter of public concern, with which the court is to deal.

The Act, then, is simple in its provisions, contains no new principles of law, and does not seek to impose upon the city any embarrassing details, or interfere with that freedom of action in regulating its own affairs which all municipalities enjoy and prize.

The draft suggested by the Commission, however, is silent as to the time within which the city shall purify its sewage: the petitioners, realizing as they do the magnitude of the work to be done, and the fact that the city has not yet done any thing in this direction, will be content with the judgment of the Commission, however liberal in this respect it may be; for when once it is known, that, by legislative enactment, the work must be done, we have full confidence that the city will in good faith do that which it is commanded to do, with all due diligence, and within a reasonable time; and with the certainty that relief is coming, the inhabitants of the valley will regain their confidence, and once more look upon the future of their business and their homes with pleasurable anticipations instead of the present mistrust.

The bill being before you, the question comes, Who asks for it? Five thousand people ask for it. Who are they, and where do they come from? They are residents of the Blackstone Valley, who are to be directly and beneficially affected by its provisions. They are from all classes in the communities along the river, — the mill-owner and the mill-operative; the merchant and his clerks; the mechanic and the farmer; the day-laborer and the employer; the wives and mothers who care for the homes of their husbands and children, who, in the factories and shops and schools, are subjected to the dangerous and almost deadly influences emanating from the river.

And where and what is the Blackstone Valley? Taking its name from the first settler of Boston, and extending from Worcester to Providence Bay, it has a history as an industrial centre antedating the history of Worcester as an industrial city. It is a busy valley, and, as such, has a record of which the petitioners are proud: its inhabitants have served the State and the whole country well from the beginning. The river, in its course to the sea, operated the first cotton-mill established in this country; and from that day to this, it has turned more spindles, for spinning wool and cotton, than any other stream of like size in the world. To do this, it has had to be used over and over again; so that, from its source to its mouth, it may almost be said, that the tail-race of one mill-privilege is the flume of the next one below. But its industries are diversified: not alone do the cotton and

woollen industries of the country owe a debt of gratitude to the Blackstone River and the mechanics within its valley, but every other mechanical industry has had its home there from the latter part of the last century. The General Government was supplied largely with arms and munitions of war from the town of Millbury for the war of 1812 and the Mexican war and the war of the Rebellion. The first scythes and improved agricultural implements made in the country were made at Millbury. The first paper-machinery was set up there, and for years it was the only source of supply for paper. To-day from the Rivelin Works, Millbury sends out the best edged-tools made in the country. The world-renowned invention for turning irregular surfaces was conceived and perfected at Millbury; and to-day the memory of the inventor and his invention is perpetuated in one of the beautiful halls in its town-house, in which the Drainage Commission of 1884 heard our complaints, and which is named Blanchard Hall. Then, too, at Millbury was conceived the principle of interchangeability of parts in machines and implements, which revolutionized their manufacture, and now prevails elsewhere in the country, and made possible successful competition, by American mechanics, in the manufacture of watches, machinery of all kinds, guns, and every other mechanical device. At Northbridge was manufactured the first cotton-machinery ever made in this country; and from that source the mills of the country have been largely supplied with their machinery, and new improvements in that particular have there been invented and applied.

I speak of these things, gentlemen, to show that the petitioners before you have had and exercised rights and privileges, and have performed useful functions in the State, long before the acts of the city of Worcester infringed upon them; and they are not in the condition of persons who have voluntarily established business and homes under the condition of things that now exist, and of which they complain. While having a county pride in the growth and development of Worcester, they cannot forget that the city owes her prosperity largely to the commerce that comes to her from the inhabitants of the Blackstone Valley.

These are the people, then, who ask this legislation. The city government of Worcester alone protests. Its able and

eloquent alderman representing it says, "The city is unqualifiedly opposed to this or any other legislation looking to the same end." But the city government in this matter is not a representative body; it was not elected upon this issue; it does not respond to any expressed public sentiment; the danger being imminent, no meeting of the citizens has been held, instructing the government to unqualifiedly oppose legislation. On the contrary, the only meeting of the citizens ever held to consider it, took action in a friendly spirit, and in direct opposition to the position now taken by the officials. I refer now to a meeting held Nov. 14, 1885, at the call of such citizens as Judge Adin Thayer, Joseph H. Walker, Rev. George W. Philips, Senator Hoar, Congressman Rice, Stephen Salisbury, and many other representatives, at which Mr. Rice said, —

"It is not a question for Worcester to consider as Worcester simply, but as Worcester the great central municipality of Worcester County, which has grown out of the great county of Worcester; and it is not for our interest, nor is it good policy, to disregard, even for our own direct advantage, the welfare of any one of the neighboring towns . . . to see if science and ingenuity cannot devise some means for righting the great physical if not legal wrong we are doing to the people of Millbury."

Judge Adin Thayer said, —

"If we are polluting the river, whatever can be reasonably done to remedy it, we are entirely willing to do; and we are here to inaugurate, so far as we can in our capacity of citizens, measures for the solution of this problem."

Senator Hoar spoke of the Act — that is, the Act of 1867 — as providing for the presenting of claims for damages for the pollution of the river within two years from the time it was taken, and said, —

"If in six, eight, or ten years, a consequence not measured or contemplated had resulted which had destroyed the homes of the people, and reduced the value of the property of the people on the stream below, Worcester has more to do than to say, 'We have a legal right to this, and will do it with as little injury to you as possible.' The Golden Rule is the one we should apply. We should act as the City of Worcester would act if Millbury was above, and pouring its sewage down upon Worcester. That is the thing we ought to desire, and the Legislature will not long permit us to stand upon our strict legal right. We ought to look at the

question as though the Millbury people were Worcester people; and the Millbury people, as well as the Legislature, should understand that Worcester people are actuated by this spirit."

Senator Hoar in his letter of recent date, read to you in evidence, re-affirms these views, and says that time only has strengthened them. So that am I not right in saying that the city government is not a representative body on this question? From alderman down or up, as you choose to call it, to auditor, treasurer, city engineer, superintendent of sewers to city solicitor, the exigencies of their official station blind these men to the expressed sentiment of the community in which they live, and seem to justify them in refusing to express their opinion as citizens, as to the duty of that community.

You will observe, Mr. Chairman and gentlemen, with what warmth and evident feeling the city solicitor attacks the meeting of Worcester's citizens, to which I have referred you, and please note also how earnestly he argues at the views there expressed. Too intelligent not to see the force of them, and too high-minded not to feel the weight of them, he yet, with the words of Alderman Parker ringing in his ears, "unqualifiedly opposes" every thing, even the expressed wish of his own people, and for the city government of Worcester formulates the new Golden Rule; namely, "Do unto others whatever they cannot by law prevent your doing."

The question, then, being, Shall the bill be reported? and these being the parties proposing and opposing it, the question then comes, Why should it be reported?

The answer is, to meet an evil found to exist by every committee and commission that has ever been called upon to consider it.

The pollution of the Blackstone River has long since been officially recognized. Let us look at it historically.

First, The State Board of Health, as early as 1876, on p. 73 of its report, reported as follows: "The Blackstone River is probably more polluted than any other river in Massachusetts."

Second, The State Board of Health, being specially requested by the Legislature of 1881, reported as follows: —

"Mill Brook, with its accumulated sewage, empties into the Blackstone River at a point about three miles above the more thickly populated portion (the village) of the town of Millbury: . . . along the whole course of the stream for some miles below Worcester, putrefaction of the organic constituents of the sewage takes place (most rapidly in the summer months); and, as a consequence, offensive gases are liberated, which are largely the cause of complaint of this method of disposing of the sewage. That the stream at times is very offensive, is quite evident; and that this, with the gradual filling up of the ponds, will soon depreciate the value of property in its vicinity, unless some other method of disposing of the sewage of Worcester is adopted, is beyond question."

Third, The Joint Legislative Committee of 1881 recognized the evil by its report, upon which the State Board was requested to make its examination.

Fourth, The Legislative Committee of 1882, by its report of bill, Senate Docs. 220, 239, recognize the existence of the evil.

Fifth, The Joint Committee of 1883 heard the parties, and reported the bill which is found as House Doc. No. 391.

Sixth, The Joint Committee of 1884, with the evidence of former reports, both of committees and commissions, caused the appointment of the Drainage Commission, who recommend this bill. (Resolve of 1884.)

So that it appears that every board and legislative committee since 1876, that has considered the matter officially, and every special commission, have arrived at the same conclusion as to the question of whether or not an evil exists that needs the application of a legislative remedy.

And these conclusions have not been arrived at upon *ex parte* evidence: every step in the progress of events towards a remedy has been contested. Worcester has been a party to all the hearings that have been had: she has called to her aid men skilled in the art of sifting evidence, and forcibly presenting it.

And now, with the report of the Special Commission of 1882, supplemented by the report of the Drainage Commission of 1884, before us, I submit that the petitioners are entitled to consider something as settled. It has been deliberately adjudged that an evil exists that ought and can be remedied; in other words, that a nuisance is caused in the Blackstone River by the sewage of Worcester.

Without referring further to the evidence that preceded it,

I now want to call your attention to the report itself, which justifies the Drainage Commission in asking you with us to report their bill.

That the Commission regarded the resolve appointing it as fixing the fact that former hearings had determined, as it were judicially, that an evil existed, appears from p. 8 of the report: —

"We interpreted the language used in the resolve which directed us to report measures for the relief of certain districts, to relieve us of the burden of proving the need of relief. We construed the terms chosen to import an assumption by the Legislature that a condition of things existed now, or was likely soon to exist, which called for some remedial measures; and it was the character of these measures, and not the question of their necessity, which it was given us in charge to determine."

That they entirely concurred, appears from their statement on the same page: —

"And irrespective of the precise text of our Commission, we should have been forced to this conclusion by consulting the reports of our predecessors in the same fields of labor."

It further appears in the report of the engineer, on p. 218, in which he says, —

"The description given in Part I. of the conditions existing in the Blackstone-river Valley, shows that there is only one serious cause of pollution which calls for an immediate remedy. This is the nuisance caused to the towns below by the discharge of the sewage of Worcester through Mill Brook into the river."

In addition to the evidence which results from the conclusions arrived at by committees, boards, and commissions, and covering a period since their examinations and reports were made, and that you may, independently of all former evidence, determine the question anew as to the existence of the evil, we have offered you some evidence of its present existence, and in increasing and alarming proportions. Without in detail considering the evidence of each witness, we may sum it up as follows: Within the territory near to the river, the death rate is increasing, and is much larger than in localities remote from the river, and is out of proportion to the total death-rate in town; the health-rate is low, convalescence

is tardy, and symptoms of disease of an obscure type are found: this is the concurrent testimony of the physicians of Millbury.

That such a condition of things might be expected under the circumstances, appears probable in view of the opinion of eminent medical men, as expressed in the letter of the health officer of Providence, Dr. C. V. Chapin, which appears in the report of Samuel M. Gray, the city engineer of that city. Speaking of the effect upon public health of emanations from rivers, he says on p. 143, —

"The foul water may effect an injurious influence in two directions: it may affect health in a general way without producing any particular or specific diseases, or it may be an important factor in the production of such diseases."

He says frankly on p. 144, —

"While it is certain that our public waters exert an injurious influence upon health by rendering the atmosphere impure, there is considerable doubt as to whether they have been directly causative of any specific diseases.

"I believe that cholera and typhoid-fever may be produced by exactly such conditions as exist in our midst. And as these conditions must steadily become worse, unless active measures are immediately taken to prevent it, the danger will, of course, increase from year to year."

We have also given you evidence of a marked increase of deposition of foul matter in the ponds, and upon the bed of the stream, and a reduction of water-power resulting therefrom.

There is evidence, too, of a depreciation in value of property, not conclusive, I admit, not entirely satisfactory in and of itself, because other causes may have been operative, which in combination with this may have produced the observed result; but look at the facts as they appear, and say whether or not this is one of the causes.

The Burling Mills are destroyed by fire; there are left to the corporation a mill-site, a water-privilege, tenement-houses, and building, such as a factory-village requires, and an otherwise valuable property; but the water-power is only useful at best for turning the wheel, and cannot be used for any other of the many uses for which it is wanted. The nearness

of the polluted stream is offensive to employees; and as a consequence the privilege is abandoned, and the village is literally deserted.

More or less empty tenements in the vicinity of the river attest the fact that there is a something operating which makes them undesirable for residences; and why seek a remote cause when a sufficient one is so near, — a river of filth flowing sluggishly by?

The selling-price of property, under a diminished demand, proves also a reduction of values right in the heart of the village, where the opposite result should be found.

But it is not alone by affirmative evidence that the fact of an existing evil is to be proved. We are entitled to have considered the probabilities in the case.

What are the facts here that are pertinent?

In the first place, the stream itself is a small one, and not very rapid. Its head waters and various sources are within the control of Worcester; the reservoirs above, that feed it, and which were the creation of the mill-owners of the valley, have practically all been taken by the city, under various Acts of the Legislature, as sources of its water-supply. The water comes down under the regulation of the water-board of the city; and in quantity regulated by the city's needs alone, and not with regard to the river or riparian owners below the city; so that in the summer months you find flowing in the stream practically the sewage of the city in its various forms of street-washings, storm-water, house-waste, excreta, waste refuse of manufacturing processes, and generally the filth that is made in a city of seventy thousand people, and nothing in the shape of pure water to dilute it.

In quantity, in 1883, the flow per day of sewage was three million gallons: prior to that time, under a system then prevailing whereby certain reservoirs were controlled by their owners, there was added to this flow of sewage during the months of July, August, and September and October, pure water in amount varying from 3,500,000 gallons to 7,000,000 per day, being about one-third of the entire stream. Since that time the city has taken these reservoirs, and now controls them, so that, since former investigations by Commission, the flow of sewage has increased, and the flow of diluting pure water has diminished.

In 1882 there were in the city thirty-six miles of sewers. At the present time the length has increased to fifty miles, and is yearly increasing. It needs no argument to prove that the constant flow of such a large volume of pollution into so small a stream destroys it as a stream of water: it is no longer a river, but a sewer, with all that that implies.

The waste of sixty thousand people cannot be turned into such a stream without imparting to it the character of a sewer; and when decomposition sets in, as it soon must, then can it be possible that it needs argument to prove it a nuisance? It goes without argument that it must be.

I contend, then, Mr. Chairman, and gentlemen of the committee, that by abundant evidence independent of the published reports and acts of committees and commissions, you are warranted in finding that an evil exists sufficiently grave to be called a nuisance.

How is the case met by the city government upon this point? In the same way that they have always attempted to meet it; that is, by the denial that there is a nuisance. They say you haven't proved it. When the position is examined, it appears that they mean, we have not proved a condition of things that endangers the public health. Apparently nothing short of that constitutes a nuisance upon their theory. Can this position be a correct one? "Where," they exclaim exultingly, "is your increased death-rate?" Can it be possible that Worcester will grant no relief until the pestilence comes? Shall not the Legislature act until the few surviving people of the valley come and show the long roll of their dead? Must the funeral train displace the busy traffic in our streets before our cry is heeded?

Will nothing but the constant tolling of the funeral bell reach the ears and touch the consciences of the city fathers?

It cannot be that the Legislature is powerless to avert such consequences as these before the death-rate increases; prevention is better than cure: the law recognizes a nuisance other than a plague, and something other than the bills of mortality as evidence of it.

Beyond the suggestion that there is no increase in the death-rate, Worcester says nothing; she does not deny the large quantity of polluting matter turned into the small quantity of diluting water; she does not deny that offensive

exhalations arise from the stream; that streams and ponds are filled up by it; that the water is useless for any purpose other than turning wheels, and as a carrier of filth; that the dwellers upon the banks of the stream have to exclude the odor from their homes as best they can; that property is depreciated in value; and in general they deny nothing except that the death-rate has increased.

If the evils I have spoken of exist, and are caused by the sewage of Worcester, manifestly this legislation should be had if, in the judgment of the committee, it will work a cure: so that the question now comes, Will the passage of this bill result in an effectual remedy?

Representing the petitioners, I maintain that it will.

In the first place, I assume that Worcester will obey the mandate in it, and in good faith do that which the Commission say her engineer is competent to do.

The question then comes, Can she purify her sewage to the extent contemplated by the Act?

Upon this question we must, I take it, rely upon the judgment of sanitary engineers, aided by the experience of others similarly situated.

In the first place, Worcester has been, of all places in the Commonwealth, favored in this, that she has had the benefit, at the expense of the Commonwealth, of the deliberate judgment of the best minds in the country upon the question of the feasibility of sewage purification.

I am embarrassed by the abundance of evidence upon this point. I can only refer to the reports of the State Board of Health from year to year; the official reports of her own honored engineer Phineas Ball, who, familiar with every fact concerning her system of sewers, and knowing well every topographical detail involved, has put himself upon record, and says, —

"In short, it can hardly be conceived of a better locality on which to test the workings of sewage utilization in this country, where such varied experiments could be made so easily and at so small an outlay, as upon the location which can be taken for this purpose by the city. In its present condition, not much of this territory is under a high state of cultivation. Much of the soil may be called of but little present value for agricultural purposes.

"In this territory, assuming 600 acres as available for irrigation, and allowing 5,000 tons per acre as an average application, the area would consume 3,000,000 tons annually, or 2,000,000 gallons per day.

"By extension and elevation, the area could easily be increased to 2,000 acres.

"Upon the west side of the valley, there are many acres of land that would lie only a few feet above the level of the main carrier for this section, where sewage could be used to the best advantage. The conveyance of the sewage upon these lands is a simple problem."

It will be observed that this report was made in 1873, and proves, first, that the subject-matter of this hearing has been long and well considered; and second, that there is an abundance of land available for the purposes of the proposed Act.

Mr. Ball further says in the same report, —

"These facts indicate . . . the beginning of a serious attempt to find a remedy for a real, not a fancied, evil."

And further he adds, —

"It is firmly believed, that if the system of irrigation is adopted, and pursued with energy, intelligence, and skill, success will be as sure to follow the effort as it is when the same traits of character are applied to any other industrial or professional calling; and that the same rule of action which insures success in the one case, will also guarantee it in the other."

From this it appears that the evil was found to exist as far back as 1873; that it was then a real one: and the well-recognized probabilities of increase fully answers the suggestion of the city solicitor that it is now exaggerated.

Then comes the report of the Special Commission of 1882, which forms the basis of the report of the Drainage Commission of 1884.

The conclusions reached in all the reports I refer to are identical, and perhaps may best be stated in the language of the last commission, where, referring to the report of the former commission upon the general subject, and also the specific method recommended, they say on p. 40 of their report, —

"This disposition seems to us entirely feasible, and we believe it will effectually remedy the great and growing nuisance which results from the existing methods of discharge."

And in the language of the consulting engineers, Joseph P. Davis and Rudolph Hering, that, —

"The scheme proposed is one of land filtration, and the soil is well adapted to the purpose. With careful management, the result cannot be other than satisfactory."

But the city government of Worcester insist that we shall go back of all these opinions and judgments, and review the evidence upon which they are based, and the grounds upon which they rest. They insist that these men are all wrong; that after all, however eminent they may be, they are mistaken; they do not understand the subject-matter in controversy, and have been inaccurate in their observations, and in error in their conclusions; and that there is absolutely no way yet discovered whereby the sewage of a city can be purified: that somehow or other, civilization has advanced beyond the point, in its various appliances, where it is possible to do any thing with sewage, except to turn it into a running stream, and thus remove it beyond the point where it would be offensive to the super-civilized sensibilities of its creators; and so from the beginning, even unto this day, they have gone on building their sewers in the best way to get the sewage to the stream, there to take care of itself. The engineering problem with them has been a simple one; in fact, it has hardly risen to the dignity of engineering at all: but for the fact that they have an official, called a city engineer, the work might as well have been done by the street commissioners. In a country town, some man who happens to have a team of horses or cattle is elected highway surveyor of his district; and with a common laborer he stakes out on the surface of the ground, a line of ditch to carry off the water to the nearest water-course, with such filth as may fall into it. The ditch is dug: they may put a cement pipe into it, and cover it up; they may run it under a road, and arch it; but there is no scientific skill called for in laying it out or constructing it, for the end sought is simple, and the means are primitive: so in Worcester they have dug a ditch, and filled it with mason-work; and from time to time, as it became a nuisance to their own people, they have covered it over: but there is no ingenuity in their method, and no skill in its execution, beyond the ordinary skill of the surveyor and the mason.

But I do not propose to restate the opinions of former commissions and of scientific experts, or recapitulate the evidence which they offered; but I deem the petitioners for-

tunate in this, that since the last hearing, evidence, cumulative in its nature it is true, has been possible in support of those opinions, and confirmatory of the conclusions which they held.

The argument of the city has been, that all the illustrations used have been of operations abroad, where the situation was entirely different, and especially where climatic influences were more favorable than in our cold New-England climate. If we have pointed to sewage operations and disposal in England, the answer has been, that what was possible in her mild climate was entirely impracticable here. If we have said Dantzic, they have questioned the accuracy of the reading from the thermometer ; and generally, while they have conceded that the substance to be dealt with was practically the same abroad as here, and have even admitted that it was more foul if any thing than here, yet they say your illustration is pointless because from abroad.

Fortunately we can now refer you to a place nearer home. The petitioners are especially happy in referring to Pullman, because their own trouble was not unknown to the projectors of the Pullman sewage system, who watched closely the efforts made by them in 1881 and 1882 to obtain relief from the flood of pollution pouring down upon them.

I desire to put before you communications from Pullman, received since the last meeting of the Committee, which contain an answer to every suggestion that has ever been made by the city as to the feasibility of purification by intermittent downward filtration and broad irrigation. (See Pullman letters.)

But the evidence is further strengthened by the report of the Commission now under consideration ; for upon p. xvi. it says, —

" It is urged with great force, that Old England and New England differ too diametrically in their climates to admit of safe comparison. The sceptics point out that England's atmosphere is moist and equable, while our heats are tropical, and our cold arctic; that one-half the year our land is frozen solid, and the other half baked hard; that in summer the sewage will stink insufferably, while in winter it will freeze into dirty icebergs, which spring will convert into torrents of sludge and filth. Once more we fall back upon experience. At Pullman, where it is colder than in most parts of Massachusetts, the frost never prevents the flow and absorption of the sewage; and in the hottest days of July and

August, the primitive filter-field at Concord is never a nuisance, nor the lawn at the Worcester Hospital an annoyance. The sewage is warm, and melts its own way into the earth when the frost is hardest ; and no matter how hot the air, the earth has a wonderful power of deodorizing and destroying the harmful elements in sewage. This property has been so abundantly manifested in a multitude of instances, here and elsewhere, that we feel that we take no undue risk in dismissing the climatic bugbear as a a chimera. We have, then, no hesitation in recommending the adoption of this system where for any reasons broad irrigation is impracticable or undesirable, and the ocean unattainable; and we think it likely to prove always a valuable auxiliary, in combination with irrigation, where the surroundings admit of its introduction."

And again, by the evidence of the Commission's engineer, who on p. 128 says, —

"Apprehensions are sometimes expressed that the severity of the winters in our State might interfere with land filtration at that season. No trouble has ever been experienced from this cause. Sewage is so warm that it keeps the earth to which it is applied from freezing, or thaws it if already frozen. The winters at Pullman are colder than in most parts of Massachusetts, but irrigation has always proceeded there without interruption. I made a visit to that farm in February, 1885. For the five days previous the mercury had not risen to 0 Fahrenheit, and had been as low as — 25. On the day of my visit, the mercury standing at — 12, I found the sewage going on to the land, and covered by a stratum of ice from one to eight inches thick. I broke the ice, and with a spade dug a hole in the ground below, which was perfectly open. As the weather moderated, the sewage rapidly melted the ice above it."

But assuming that the land will freeze, that a coating of ice will form upon the surface, and that the sewage will flow over it into the river during the coldest of the winter months, the petitioners will uncomplainingly bear that, and you will not find us here seeking relief. It is the nuisance which the hot summer air develops which we ask to have abated, and not the inconvenience which the frosts of midwinter reduces to its minimum.

And how is this evidence met? By the testimony of the city engineer of Worcester. Under what circumstances does he testify? Let the record speak.

At a meeting of the city government, Oct. 2, 1883, the following report was made : —

"The Joint Standing Committee on Sewers would respectfully commend to the City Council the desirability of procuring, at an early day,

such information as is accessible upon the general subject of sewage as experimented upon in other countries. The natural and acquired rights of the city are constantly assailed with evidence and arguments assumed to be based on said experiments ; and in our judgment we should be guilty of gross negligence if we did not provide ourselves with a thorough knowledge of the subject, gained from an intelligent investigation of the results as they exist, *and in competent form to be offered in a court of law.* We therefore unite in recommending that the city engineer be directed to perform this duty by direction of the Joint Standing Committee on Sewers and the city solicitor, the expense not to exceed seven hundred dollars."

Under these circumstances, Mr. Allen went abroad, charged with a specific duty ; that was, to obtain evidence, if possibly it might be found, to be used in the trial of a cause in which his city was involved. He does not go with the purpose of acquiring useful knowledge that will enable him to serve his city in working out the problem of its sewage disposal, nor with the purpose of broadening his views by contact with his fellow-engineers abroad, nor to add to his accomplishments as a civil engineer or surveyor a knowledge of sanitary engineering as a science, but just for the purpose of finding out how not to do the very thing which needs to be done ; and, having fitted himself as an expert in the short space of three months, he returns, and guards with a jealous care the secrets he has wrung from his fellows abroad, and from his own observations, so that even his own townsmen, as they are here present, hear for the first time the results from the lavish expenditure of money they made in educating their engineer up to the testifying-point.

In pursuance of his instructions, Mr. Allen goes abroad ; and the places he visited prove positively we are right in saying his purpose was to find every thing that could be found adverse to the petitioners. Of all places, he apparently selected Doncaster as the one upon which to pin his faith and to base his testimony. Presumably he did this because it was a notorious fact that at Doncaster four gentlemen — civil engineers by profession — attempted to carry on a farm, and made a failure of it, — at least, did not attain that measure of success that they hoped for. And yet, in spite of the difficulties and embarrassments of his position, he brings back no such damaging facts and opinions as would warrant you in ignoring the recommendation of the Drainage Commission.

Mr. Allen is too intelligent a man not to have an opinion upon the matter he has investigated: he is too honest a man to falsify. The pressure of his superiors in the city government crushes him, and he dares not give the Committee, when he is asked, his professional or private opinion upon the matter before them.

Well may we, who hoped for relief, exclaim, —

> "O star-eyed Science! hast thou wandered there
> To waft us back the tidings of despair?"

In sharp contrast with the methods pursued by Engineer Allen was the course pursued by Mr. Gray, the engineer of Providence, who, being sent abroad, saw more than the city engineer of Worcester saw, and, returning, made that valuable report, to which reference has been made in this discussion, in which he finds not only that the sewage of a large city can be purified, but also a way in which his city can do it.

Mr. Chairman and gentlemen, I have said that the only answer the city of Worcester makes to the finding of the Commission on the question of the feasibility of sewage purification is the testimony of Mr. Allen; that testimony, reduced to its final analysis, is this: "I don't know how to do it." He confesses ignorance, admits defeat, and stands appalled at the prospect which his predecessor, Mr. Ball, regarded with hopefulness, and anticipated with professional intelligence.

But in fairness it must be said that the city solicitor does not rely alone upon this evidence, but has quoted many isolated propositions contained in the final report of the "Royal Commission on Metropolitan Sewage Discharge," published in November, 1884. We join issue with him upon this report, and refer you to it in its entirety, especially to the conclusions of the commissions found on pp. lxvi. and lxvii. of the report.

In examining this report, it must always be borne in mind that the problem to be solved by the Royal Commission far exceeded in its complexity that before our own Commission.

You cannot reason from London, the metropolis of the world, to Worcester, the heart of the Commonwealth.

The former Commission had to deal with the sewage of five

million people, more than the entire population of New England, and one-twelfth the population of our entire country.

The operations of the one were to be in a city that was old when our continent was discovered, the other in a city incorporated within the memory of witnesses before you.

The sewage of the latter could be cared for on a tract of land of six hundred acres: the former, on the same basis, would require a tract of land of fifty-seven thousand six hundred acres, or ninety square miles.

Mr. Chairman and gentlemen, what may be called the defence of the city, so far as evidence is concerned, rests here: all else that is urged against the report of the bill may be said to be matters of law, and an appeal to what they are pleased to call good faith on the part of the Legislature.

Not caring to indorse the notion of the alderman, who testified that the city has riparian rights which will be infringed by the proposed bill, the city solicitor ingeniously, but not accurately, calls the city a riparian city, and asserts that she is doing only what at common law she has a right to do; that is, by the common law she could turn her unpurified sewage into the stream.

In support of this proposition, they rely upon the case of *Merrifield* vs. *Worcester*, 110 Mass. 216; but that case decides that the plaintiff's only remedy was by a *petition under the Act of 1867.*

Again, they cite *Washburn & Moen* vs. *Worcester*, 116 Mass. 458; but the court there re-affirm the doctrine of the former case, that damages can only, under the circumstances of the case, be recovered by petition under the Act of 1867. Both of these cases are fully considered in the report of the hearing in 1882, which is before you.

The more recent case of *Morse* vs. *Worcester*, 139 Mass. 468, is still pending before the court, the demurrer of the defendant city having been overruled; and the *dictum* of the court, that for certain supposed conditions a remedy had better be sought from the Legislature, is directly in conflict with the position assumed by the city solicitor, that the city is only exercising its common-law rights.

All of these cases, instead of proving that the city is exercising its common-law rights, are directly to the contrary, and establish the doctrine that the rights which parties had at

common law were taken from them by the Act of 1867; and it is in consequence of this that the petitioners are now before you, as representatives of the Legislature, the only tribunal that can redress their grievances.

It is then said that this bill should not be reported, because it would interfere with the rights acquired by the city under the Act of 1867, and that it would be a gross violation of the public faith, which by that Act was pledged to secure forever to the city the right to empty its sewage into the stream. It is admitted that the suggestion would lack force if the right granted had been one for which the city had nothing to pay: but it is contended, that, inasmuch as the Act provided for compensation, it must be presumed that compensation was made; and you are referred to a petition brought by Washburn & Moen, under the Act, which is said to be now pending. I hazard nothing in saying that the city of Worcester has never paid one penny as damages on account of the Act, unless it was to Washburn & Moen; and it is a notorious fact, that in their case proceedings were suspended, while the city took out of their pond all its sewage, and, by a new sewer costing upwards of two hundred thousand dollars, carried the entire volume of it out of and by their pond, and turned it on to the people a half a mile below them. Just what settlement was made with them beyond this, has been carefully kept from the public, so that they are as ignorant of it as of the experience of the city engineer in his search for evidence.

It will readily be seen that the evils of which the petitioners complain would not develop themselves within two years, and then, by the terms of the Act, they had lost their remedy; and can it be seriously urged that the public faith was so far pledged as to forever authorize the city to do acts, however injurious, the consequences of which could not then be foreseen, and which would not exhibit themselves in any event until the time had expired within which a remedy could be had?

Can it be possible that the public faith is pledged to a scheme which takes away valuable rights, and substitutes a nuisance?

Has the Legislature no right to repeal or modify a gratuitous grant which operates to convert a river into a sewer?

The only remedy, Mr. Chairman and gentlemen, that has ever been suggested by Worcester for the evils we have considered, is to *pull down the dams;* mark the simplicity of it; note, too, it involves no act on the part of the city; it is as though I said to my neighbor, who complains of my filth, "Clear out the drain on your land, so that the overflowings of my cesspool, and the waste from my sink-drain, may flow unimpeded and quickly to you and away from me."

They answer our complaints by referring us to what they are pleased to call a natural law; namely, that water must run down hill: but the answer is not satisfactory. Imagine, if you please, a man is passing along the street where he has a right to be; the window above him is opened, and a bucket of slush is turned upon his head; would it be entirely satisfactory if, in answer to his complaint, the offender replies, "My dear sir, I'm sorry for you; but you were below, and it only went down in obedience to the laws of gravity."

It needs but a moment's reflection to realize the folly of the proposition that relief would come, and justice be done the city and the valley below, by pulling down the dams. This means depopulation of the valley; for without our dams, our wheels cannot turn; without them our mills stop, the operatives scatter, the rest of the community dependent upon them must go elsewhere. The logical end would be an aggregation in cities, no rural population, and a filthy sewer from Worcester to the sea. Worcester cannot afford this, for by the commerce of the people clustered around the dams, she thrives; the Commonwealth cannot afford it, for Massachusetts needs every foot of water-power within her borders if she is to maintain her position as a manufacturing State: there are no elements of statesmanship in the proposition; there is no ingenuity in it; there is no genius in it; it is a confession of inability to cope with a difficulty successfully dealt with elsewhere; it is an acknowledgment of defeat, for the community that cannot take care of its own excrement is a failure.

True, it is said that steam can be used; but the answer is twofold. The comfort and health of the operatives in the mills will be affected by the current of pollution running by them, for a running stream of pollution is the result after decomposition sets in; and for this reason, if for none other,

you have a proscribed district, shunned by the skilled operatives upon whom alone success depends, and without whom profits are at first precarious, and ultimately impossible: natives flee such a district, and foreigners shun it.

Then, too, the increased cost of operating the mills by steam would practically prevent their operation at all; for the margin of cost between water-power already established and equipped, and steam, to be established, is the profit upon which the manufacturing industries outside the cities thrive, and are made profitable and remunerative.

Assuming, then, Mr. Chairman and gentlemen, that an evil exists; that the city of Worcester, under the Act of 1867, created it; that, with reasonable certainty, a remedy can be found; and that the bill recommended by the Commission will effectuate it, — the question then comes, Shall the remedy be now applied?

The city, through its legal officer, says no, and asks that action be postponed, so that this and all other matters embraced in the report may be further considered by the cities and towns affected by the recommendations of the Commission.

The answer is twofold: first, the danger to be averted is imminent, and admits of no delay; and second, the subject-matter has been well considered: all parties interested have long been conversant with it.

A reference to the report of the hearing of 1882 shows that the mayors of the city, from Judge Chapin, in 1871, to Dr. Kelley, in 1881, in their inaugural addresses, called the attention of the people of Worcester, and especially of the city government, to the increasing complaints from the people of the valley, and to the duty which they owed, in the language adopted by Mayor Verry, "to so use their own as not to injure another."

It is a fact, not without significance, that since 1881, when the people below, having found that nothing came of the fair suggestions of the inaugurals, began actively to move and press for legislation, the various succeeding mayors have either avoided the subject altogether, or have touched upon it very generally, and, as a rule, have assumed that there was nothing that the city ought to do, because there was no power at law to compel her to do it: in other words, the

Golden Rule, as formulated by the city solicitor, has been indorsed by the mayors.

This is illustrated by the inaugural of the present mayor, in which he says, in speaking of the complaints of the petitioners, "While acting in our official capacity, we must be just to our own people before we are generous with our neighbors;" so that you will observe the Worcester idea of generosity of to-day, while it is entirely at variance with that of Mayor Verry, yet forms, consistently, a part of the code of ethics upon which the argument of the city solicitor is founded.

But, from whatever stand-point the officials have viewed the question, the fact remains, that for fifteen years it has constantly been before them; year by year the complaints have increased; year by year the evidence has been accumulating, until to-day there is a strong and abiding conviction on the part of the thinking people of the city, that the complaints are too well founded, and that absolute justice, and not mere generosity, demands that they be heeded.

In fact, the reasons urged for the postponement of action upon other portions of the report of the Commission are reasons for action upon this; if postponement is desirable for want of consideration in some localities, this has been well considered; if delay is asked by some communities affected by the report because of the complexity of the provisions relating to them, this is marked by simplicity; if the recommendations of the report in other instances involve the relations of two or more municipalities, this bill affects Worcester alone.

If, as contended by the city, the subject-matter of the report is experimental, then Worcester is the best place in the Commonwealth to try the experiment, as appears by the reports of every commission, and also by the evidence of her own engineer, Mr. Ball.

In conclusion, Mr. Chairman and gentlemen, these petitioners feel that something must be done to avert a great calamity: the instinct of self-preservation impels them. The people of Worcester feel that something ought to be done to remedy the great and fast-growing evil for which they are responsible: their sense of justice impels them. Sanitary engineers tell us that an effectual remedy has been

found. The Commission are of opinion that Worcester should be required by law to apply it, and every consideration for the public welfare demands action at the present time.

Let this bill become a law, and the city will obey it. With her splendid resources she will call to her aid the best engineering skill to utilize her great natural advantages. Her skilled mechanics and artisans will execute the details of a work of which she will be justly proud; and Worcester, proud heart of the Commonwealth, as she loves to call herself, whose every pulsation should send life and health throughout the valleys that surround her, will regain the respect and honor which are her due.

EXTRACTS FROM THE SECOND AND FINAL REPORT OF THE ROYAL COMMISSION ON METROPOLITAN SEWAGE DISCHARGE, NOVEMBER, 1884.

Referring to the prospect of profit from the utilization of sewage, they say, —

"Looking, however, to the fact that sewage does contain elements of value, and that the aggregate value of the metropolitan sewage is undoubtedly very large, we think the possibility of realizing some of the value should be borne in mind in devising plans for its disposal. And it is clear that our present knowledge points to the application to land as the most probable mode by which this can be done.

"But we are strongly of the opinion that it would be wrong to delay proceedings on this account, and that freeing the Thames from pollution must be undertaken as a work to be done and paid for, whatever the cost may be" (p. xxxvii.).

With reference to broad irrigation, they say, "We are of opinion, —

"1. That, generally speaking, it offers a satisfactory mode of disposal of town sewage where circumstances admit of its application.

"2. That it offers the most likely means of realizing some portion of the value of the sewage.

"3. That when properly arranged, and carefully conducted, the effluent will be effectually purified, but that under careless management the purification may be incomplete.

"4. That it need cause no danger to health.

"5. That with proper care, when applied on a moderate scale, it need cause no serious nuisance to the surrounding neighborhood, but that, if improperly managed, nuisance may arise, and become considerable" (p. xliii.).

Reporting on the filtration system, they say, —

"It will now be understood that the essential difference between the intermittent filtration system and that of ordinary broad irrigation is as follows: —

"Broad irrigation means the distribution of sewage over a *large* surface of ordinary agricultural ground, having in view a maximum growth of vegetation (consistently with due purification) for the amount of sewage supplied.

"Filtration means the concentration of sewage, at short intervals, on an area of specially chosen porous ground, as *small* as will absorb and cleanse it; not excluding vegetation, but making the produce of secondary importance" (p. xlvi.).

"With regard to filtration through land, we are of opinion, —

"1. That the process has great scientific merit, and offers valuable practical advantages for the disposal of sewage in situations where broad irrigation is impracticable, and where land suitable for filtration can be obtained.

"2. That, however, it appears desirable, when the area of land is considerably reduced, that the sewage should be previously treated by some efficient process for removing the sludge.

"3. That an arrangement of this kind would be applicable to the metropolis, as we shall explain more fully hereafter" (p. xlviii.).

"In discussing the treatment of sewage by chemical precipitation, we have pointed out that the clarified liquid, though improved, still contains a considerable amount of impurity.

"And we have also noticed in a former place, the remarkable effect of application to land in purifying sewage-water from its noxious properties.

"Hence it is a natural inference, if these two processes could be combined, — that is to say, if, after chemical clarification, the still impure liquid could be applied to land, — the purification would be completely effected, and at the same time some advantage might be gained by the utilization of the fertilizing matter" (p. lviii.).

"CONCLUSIONS AND RECOMMENDATIONS.

"2. We are of opinion that it is neither necessary nor justifiable to discharge the sewage of the metropolis, in its crude state, into any part of the Thames.

"3. We are of opinion that some process of deposition or precipitation should be used, to separate the solid from the liquid portions of the sewage.

"4. Such process may be conveniently and speedily applied at the two present main out-falls.

"7. The liquid portion of the sewage remaining after the precipitation of the solids, may, *as a preliminary and temporary measure*, be suffered to escape into the river.

"10. But we believe that the liquid so separated would not be sufficiently free from noxious matters to allow of its being discharged at the present out-falls, as a *permanent* measure.

"14. In new drainage-works, the sewage should be, as far as possible, separated from the rainfall" (p. lxvi.).

EXTRACTS FROM THE REPORT OF SAMUEL M. GRAY.

Samuel M. Gray, city engineer of Providence, R.I., having, under instructions from the city council of that city, investigated the matter of sewage disposal abroad, reported, under date of July, 1884, as follows: —

"As the result of my investigations and study of this question, I recommend, first, that intercepting sewers be built; second, that the sewage of the city be conveyed to Field's Point; third, that it be treated there by chemicals in such a manner as to precipitate the matters in suspension, and to clarify the sewage; fourth, that the clarified effluent be emptied into deep water at Field's Point."

After describing in detail the system he recommends, he says, —

"No system of sewerage is complete which fails to dispose of the sewage so as to avoid its causing a nuisance. It is believed, that, if the scheme herein recommended is thoroughly carried out, the Providence River and its tributaries may be reclaimed from their present filthy condition, and that the air, which is now so often laden with foul gases rising from their waters, may be preserved pure and wholesome. . . . The system herein recommended is not new, the constructions involved are not experimental: they are in successful operation in many of the towns and cities of Europe" (p. xvi.).

He says further, —

"No difficulty is reported in disposing of sewage by irrigation during winter, either on the Continent or in England. In Germany, where the climate is similar to our own, as at Dantzic and Breslau, the irrigations are reported to be uninterrupted in winter by the frost. Vegetation not existing in winter, the purification of the sewage is effected solely by the action of the soil. The tempera-

ture of sewage has been frequently observed at different seasons of the year, and it has been found to be relatively warm in winter, and cool in summer.

"At Dantzic the temperature of the sewage is said not to fall below forty degrees Farenheit at the pumping-station, and forty-two degrees at the point of delivery to the irrigation-fields. Its temperature in summer is said not to rise above fifty-nine degrees at the pumps, and forty-eight degrees at the outlet. Between the pumping-station and the irrigation-fields, the sewage is conveyed in three siphons beneath the Vistula and the ditches of the fortifications, and is carried under ground in closed pipes, to the irrigation-fields.

"The irrigations are continued throughout the winter at Dantzic without interruption, in spite of the severity of the climate. The sewage is said to arrive at the fields at a temperature of forty-two degrees Fahrenheit, even during the greatest frosts. It melts the snow and ice, and continues to percolate into the ground, without causing trouble to the tenant of the farm.

"The severity of the winters at Dantzic is such that the ground freezes from one to three feet deep. Water-pipes are laid five feet under ground. The temperature of the air falls at times to eleven degrees below the zero of Fahrenheit. Snow falls as early as October, and as late as April. The rivers at Dantzic are frozen from the middle of November to the last of April.

"The following table gives the mean monthly temperatures at Dantzic for eighty-one years, together with the mean monthly temperature at Providence for forty-eight years.

MONTH.	MEAN TEMPERATURE.	
	Dantzic.	Providence.
January	26 8	26 78
February	29 1	27 33
March	32 4	33.90
April	41.2	44.50
May	50.4	55 14
June	58 3	65 15
July	62 8	70.69
August	61.9	68 78
September	54 5	61 17
October	44 1	50 74
November	36.3	40 00
December	30 0	29.73

"At Breslau . . . no trouble is said to be experienced from frost at the irrigation-fields, although the soil is not as porous as

at Dantzic. The frost enters the ground from two to four and one-half feet deep" (Appendix A, p. 93 *et seq.*).

THE PULLMAN SEWAGE-FARM.

The Pullman sewage-farm is located at Wildwood, Cook County, Ill., a station some three miles south of Pullman, on the Illinois Central Railroad. The farm consists of some 170 acres: of this, about 140 acres are underdrained. This large area of land was not secured because of immediate needs, but for the reason that it may all be required in the near future, owing to the phenomenal growth of the town whose necessities it serves. In the opinion of the manager of the farm, not far from *ten acres* would be sufficient to care for the present flow of sewage; the population being now about 8,600. After the sewage leaves the village-mains, it is collected in a great cesspool, which (for convenience only) occupies the basement of the water-tower, and from thence is pumped to a distributing tank at Wildwood, where it is screened; and all portions which fail to pass a half-inch screen are rejected.

The pressure at the "Tank-house," Wildwood, amounts to nearly ten pounds.

The system of sewage disposal now in use at Wildwood, has had from four to five years' trial, and is considered a perfect success; the experimental period having long since gone by. This system is equally effective at all seasons of the year; the only difference being, that in the coldest weather a little larger area must be used for flooding purposes. During the cold weather a coating of ice of greater or less thickness is formed over the flooded portions of the farm; but the ground below is *never frozen*, even with the mercury at twenty-five degrees below. From the distributing tank the sewage is carried beneath the soil (below the line of frost) by means of vitrified drain-pipe; and from these arise hydrants, which convey the sewage into troughs, which may, or may not, be used in its distribution over the surface. The soil here is called "sandy," yet it is far richer than the soil of the average New-England farm. Below this surface is a substratum of the toughest blue clay, which extends to an unknown depth. Thus far the Pullman soil has absorbed all the sewage which has been offered, and has shown no signs of saturation. The crops raised are onions, cabbages, celery, cauliflower, beets, tomatoes, etc. Most of these have been cultivated with the greatest success, the only doubtful crop being Irish potatoes. Not only is the quantity raised very large for the area, but the quality of the vegetables raised here is of the very best, and nearly always commands the preference in

the market. These vegetables are sold all over the county, east of the Missouri River, and especially are they in demand at the South. The total first cost of this farm was nearly $130,000, divided nearly as follows : —

140 acres land @ $350 . . . . . cost,	$49,000
Pumps, 3 miles 20-inch pipe, tanks, buildings, hydrants, etc. .	70,000
Laying pipe under 140 acres	7,000
Tools, teams, etc.	3,000
Extras	1,000
Total	130,000

You will notice that the first cost of the land seems very large for farm-land ; yet this same land could not be bought to-day for $600 per acre, without the improvements.

The sewage investment shows a very good profit thus far. When we consider the high cost of the land, the distance of most of the markets, and all other expensive features in construction and management, the result is truly remarkable. This result shows not only that the sewage of our cities can be disposed of, but that it can be done at an *actual profit*, and in a way which will not be detrimental to the public health. For proof of this, I respectfully refer you to the letter from the farm-superintendent, and to the small death-rate among the people of Pullman. There are many other features of this model town well worthy the attention of legislators, scientists, and philanthropists ; but none show better the wise forethought and humane purposes of Mr. George M. Pullman, than do the practical results of this model sewage-farm. For the data with which to compile the above, I am greatly indebted to Messrs. E. T. Martin, E. W. Henricks, and William Davis.

Very truly,

H. H. WATERS.

Chicago, March 29, 1886.

PULLMAN'S PALACE CAR COMPANY,

TOWN OF PULLMAN.

Pullman, Ill., March 29, 1886.

O. H. Waters, Esq., Millbury, Mass.

Dear Sir, — I have read an article prepared by Mr. Waters on the Pullman Sewage Farm, and I take great pleasure in saying that the facts are properly stated, and the conclusions entirely correct.

Yours truly,

E. W. HENRICKS, *Agent.*

PULLMAN FARM.

Wildwood, Cook Co., Ill., Mar. 29, 1886.

O. H. Waters, Esq.

Dear Sir, — I have read the accompanying article on the Pullman Sewage Farm, and take pleasure in stating that it states things about as they are.

I question if ten acres would thoroughly purify our sewage for any great length of time ; but as we apply it, say for two or three months, then crop the land, it is purified thoroughly and perfectly.

It is unquestionable that the sewage, as we handle it, is taken care of without nuisance or offensive odor; that the health of the farm-hands living in the immediate neighborhood of or on the farm, is much better than that of the inhabitants of Riverdale or Dalton, two or three miles from the farms ; and that on the average a fair profit can be shown above the operating expenses, and cost of taking care of the sewage

I may add, that for four years my house has been supplied constantly with vegetables grown on the farm; that visitors say they have never eaten a better grade; that our trade is constantly increasing, through the superior quality of our produce, last year I refusing orders for some twenty car-loads of cabbage and onions; and that so far from my own health, or that of my family, being injured by our having the sewage all around us, or by our eating the products of the farm, it has been improved, my own weight now being thirty pounds more than when I took charge here between five and six years ago

As the farm now is, we could take care of the sewage of a city of over twenty-five thousand inhabitants.

The ground receives the sewage in very cold weather nearly as well as in summer.

The effluent is used for steam, and often for watering horses, and is so pure that fish may at any time be found in the manholes, and at the mouth of the main underdrain.

Very respectfully,

E. T. MARTIN, *Superintendent.*

Chicago, March 29, 1886.

Hon. O. H. Waters, Millbury, Mass.

Dear Sir, — Your queries, with reference to the purification of the sewage by the method used at Pullman, I have the honor to answer as follows: —

1. " Can sewage be purified by the process in use at Pullman ? "

Experience at the Pullman farm demonstrates conclusively that sewage can be sufficiently purified by ground to be admitted to flowing streams, and this at all seasons of the year; though, of course, the purification is more perfect in warm weather — particularly during the growing season — than in cold.

2. " Is this process adapted to the use of a city of one hundred thousand people, provided the works are proportionately large ? "

So far as the purification of sewage is concerned, this question can

only be answered in the affirmative; but so far as it relates to the financial results, no positive answer could be given without knowing all the circumstances of markets, etc.

3. "Will not the soil become saturated by sewage so as to be unable to accomplish the purification claimed after a few years' use?"

It is manifestly impossible for organic matter to permanently clog the pores of the ground; as all such matter is subject to destruction by decay, and there are no solid substances other than those of an organic nature in Pullman sewage.

It is, of course, impracticable to continue the application of sewage to one tract of land without intermission with good results.

Intermittency must be observed in all such cases.

4. "Can a sewage-farm be conducted so as to become self-supporting?"

An answer to this question is also subject to qualification. The Pullman farm is more than self-supporting; and, in my judgment, there are numerous places where a like result can be obtained.

5. "Do you consider the Pullman project a success for the purpose desired?"

The sewage disposal at Pullman is undoubtedly a success in the accomplishment of the prime object aimed at; viz., the purification of the sewage in a way to be self-sustaining.

It should be said, in this connection, that the success attained at Pullman in the disposal of the sewage during cold weather, is possibly partly due to the fact that no effort is made to run the sewage through long, open ditches, nor over the surface of a great area of land; the sewage distribution being by underground pipes below frost, with frequent outlets through hydrants.

6. "What is the cost?"

The accounts kept by the Pullman Company include three miles of twenty-inch cast-iron main from the village to the farm, and, owing to parts of the land not being fully prepared, gives no idea of what the actual cost of the drainage and distribution systems is.

One tract of sixty acres that was first prepared, and which, with the exception of ten acres afterward under-drained twelve and one-half feet apart, was more thoroughly under-drained than any other part of the farm, cost as follows: —

For under-draining thirty-seven and one-half feet apart, $7,260.00.

Total cost of distribution, exclusive of main pipe to farm, $9,600.00, or an average of $281.00 per acre for both the drainage and distribution. A considerable part of this amount is properly chargeable to another tract of land.

Respectfully yours,

BENEZETTE WILLIAMS, *Engineer of Works.*

WASHINGTON, Feb. 27, 1886.

My dear Sir, — You are quite right in your belief that I meant exactly what I said in the remarks from which you quote. My opinion is unchanged, except so far as it is strengthened. But I cannot under-

take to give an opinion as to any particular plan of remedy until I have had opportunity to know what it is, and hear it discussed. I think Worcester ought to do, and means to do, just what she would if Millbury were part of her own territory. I cannot do much more than to give my voice and vote for her action in that spirit. I have had no time to read the report of the Commission. I have hoped much from the joint committee of which you are a member, but I have seen nothing of its action.

I am yours faithfully,

GEO. F. HOAR.

COMMONWEALTH OF MASSACHUSETTS.

THE WORCESTER LUNATIC HOSPITAL.

WORCESTER, MASS., Feb. 16, 1886.

GEO. C. WEBBER, M.D., Millbury.

Dear Sir, — The method for the purification of the sewerage of the hospital continues to be satisfactory.

We have no trouble in cold weather.

Very respectfully,

J. G. PARK, *Supt.*

EXTRACTS FROM RIVERS' PURIFICATION ASSOCIATION, LIMITED. — THE COVENTRY SEWAGE-WORKS.

The following correspondence dates from the establishment of the Works in April, 1874, up to 1880, and shows the efficiency of the operations, and their complete freedom from any nuisance.

FINHAM PARK, KENILWORTH, 14th July, 1874.

DEAR SIR, — In answer to your inquiry as to the pollution of the river Sherbourne, I beg to say it has very considerably abated since the late alterations at the Sewage Works. I have not seen a dead fish since, but have noticed large numbers of them enjoying themselves by flirting out of the water, during the late hot weather.

There is a considerable quantity of mud on the banks, the accumulation of past time, which, no doubt, the winter floods will carry away; and then, I have no doubt, we shall find a still further improvement.

Believe me, dear sir,

Yours faithfully,

JAMES WESTON.

J. C. MELLISS, Esq.

WHITLEY ABBEY, COVENTRY, 8th August, 1877.

My dear Sir, — I was very much pleased on my return home, about a fortnight ago, to see and feel the improvement in the state of the river Sherbourne. There is really nothing to complain of now; and if it can only be maintained in its present condition, I do not think I am likely to trouble your Corporation any more on the subject. I must at the same

time tender my thanks to the Corporation for the successful efforts they have made towards remedying this nuisance.

I remain,

Yours faith ully,

EDWARD PETRE.

T. Browett, Esq., Town Clerk, Coventry.

Note. — The fact that this gentleman had been, previously to the erection of the present sewage-works, in litigation with the Corporation for polluting the river, increases the strength of the testimony given by his letter.

Royal-Oak Inn and Tea-Gardens, Whitley,
Oct. 5, 1880.

To the Rivers' Purification Association.

Gentlemen, — I have now kept this inn for four years, and during that period I have never had occasion to complain of any nuisance arising, either from your works or the filter-beds, notwithstanding that the latter join my Tea-Gardens, and the works so close; nor have my numerous customers ever found fault, or my trade been injured.

Yours truly,

WALTER BUTLER.

Whitley Villa, near Coventry,
26th February, 1877.

Dear Sir, — In reply to your letter, I have much pleasure in stating that I consider the works and process for purifying the river Sherbourne are perfectly successful. Living as I do in close proximity to the works, I should be the first to suffer were they obnoxious or offensive; but I am glad to say I have no fault to find, and consider Whitley as healthy as any place in the district.

I may add incidentally that the value of the property here has lately increased, I myself having raised my tenants' rents.

I remain, dear sir,

Yours truly,

THOMAS L. GILLOTT.

E. F. Coddington, Esq.

CROYDEN.

Croyden has a population of 80,000, and collects sewage from about 65,000 inhabitants. The dry-weather flow of sewage amounts to about 4,700,000 gallons. This quantity is augmented in times of rain by rain-water. The sewage is disposed of by what is known as broad irrigation, and is applied to about 450 acres. This farm is about a quarter of a mile from the nearest inhabited district. The soil is light and gravelly. The land is drained only by a few large, deep drains. Grass, marigolds, cabbages, etc., are raised in large quantities. The grass is cut from three to six times in a season. The animals fed on the crops are well, and the milk produced is of the best quality. The sewage is applied to the land from two days to as many weeks at a time.

The farm gives rise to no bad odors. This farm has been in operation for about twenty-four years. The land is said to absorb the sewage as freely now as when the farm was started.

The effluent from the sewage is clear, and free from smell, and in appearance resembles spring-water.

The sewage thus disposed of is without danger to health, or a nuisance to any one.

Many other places where similar results are attained might be mentioned.

Berlin, Germany, disposes of the sewage from about 900,000 inhabitants in the same manner and with good sanitary results. The sewage of 100,000 inhabitants at Dantzic, Germany, where the climate is similar to that of New England, is disposed of by irrigation without inconvenience.

Breslau, Germany, with 300,000 inhabitants, disposes of its large amount of sewage by broad irrigation, and thus avoids causing nuisance.

Many other places might be mentioned where sewage is successfully disposed of by irrigation.

COVENTRY.

Coventry, Eng., is a city of 45,000 inhabitants. The sewage is collected from the entire population, there being some 9,000 water-closets in use. The dry-weather flow of sewage amounts to two and a quarter millions gallons. In times of rain this quantity is increased, all the rain-water falling being admitted to the sewers, besides waste products from manufactories, amounting to upwards of 50,000 gallons per day, and composed of dye-water from silk and wool works. The sewage is treated by what is known as the

Coventry process, mechanical straining, precipitation by means of crude sulphate of alumina, salts of iron, and small quantity of lime.

The effluent from this is passed through land. Some eight tons of pressed sludge are thus obtained, which is used as dressing for the land. The effluent is very good, and is discharged into the river Sherbourne, the volume of which is often less than the amount of effluent from the sewage-works.

These works have been in operation upwards of ten years.

LEYTON.

Leyton, with 35,000 inhabitants connected with the sewers, has about 1,000,000 gallons of sewage per day. This sewage is mechanically strained, and then precipitated by means of crude sulphate of alumina, salts of iron, and a little lime.

The effluent is bright and clear, and almost odorless. It is discharged into a branch of the river Lea, the quantity of effluent being to the flow of water in the stream as about one to six.

About six or seven tons of sludge are produced per day, which is taken away by the farmers for land-dressing. The sewage is thus disposed of without causing nuisance to any one.

Among many other places which might be mentioned where chemical precipitation is successfully practised, is Aylesbury, Bradford, Hertford, Leeds, etc.

IRRIGATION.

"The most natural way of disposing of sewage, — the way which first suggested itself by the analogy of the old way of disposing of excreta, — was to apply it to land by a process of irrigation as liquid manure; and, by the application of ordinary agricultural knowledge, this system has become very effective."

"The sewage, by a judicious arrangement of channels, or carriers, is allowed to flow over the surface of the land on which crops are growing; part of it is absorbed and assimilated by vital action in the vegetable growth; part of it filters away through the more or less porous soil; and part flows over the surface to channel-drains which convey it away as an 'effluent.'"

"The important result of the process is, that the noxious and offensive elements of the sewage are either beneficially appropriated to the crops, or are detained in the soil by the mechanical filtration, or by the long and repeated exposure to the air are decomposed, oxidized, and changed into innocuous matters, so that the effluent runs away in a comparatively pure stream. At the

same time the fertilizing ingredients in the sewage are utilized by manuring the land, and promoting the vegetation."

"To apply this process so as to obtain the utmost benefit from the sewage, a large area of land must be employed, for which reason the system is termed *broad* irrigation, to distinguish it from another species of sewage application to land (hereafter described), where a much smaller area of land is made to suffice."

"The Sewage Commission, in their report of 1858, mentioned many towns where the system was at that time beneficially employed; but it has made great progress since that date. In a return made to the House of Commons in 1875, eighty-seven towns were mentioned as adopting irrigation; and the number has now much augmented, many very populous places disposing of their sewage in this way."

. . . "We may now add extracts of the evidence on the same point taken before ourselves."

Sir R. Rawlinson. — "If you could provide an acre of land to each one hundred individuals, and that land were properly prepared and properly attended to, you might irrigate it from year to year without producing any disease." . . .

"Many towns dispose of their sewage by broad irrigation without causing a nuisance, and at the least cost to the rate-payers. The disposal of the sewage is satisfactory."

Mr. Brundell. — "Where a very high standard of purity is required, I know of no process equal, as a means of cleansing the sewage, to the use of land in the way I have described."

Col. Hope. — "Irrigation is the only complete and absolute remedy, and the only remedy which holds out any prospect of making the two ends meet."

Mr. Baldwin Latham. — "As a rule, I am very much in favor of applying sewage to land where it can be done: as there is no doubt that that is one of the most economical and the most satisfactory modes of producing a *good effluent*." . . .

"There is no evidence to show, so far as experience in connection with existing sewage-farms is concerned, that they exercise any baneful effect on health."

"I should not, however, consider it a proper thing to distribute sewage over land from which the probable future water-supplies of the metropolis may be largely procured; namely, from the chalk formations around London."

"Although there are many points in regard to this system in which the authorities differ in opinion, there can be no doubt of the general conclusion, — that the results of experience, and of the investigation of the subject by the most competent authorities, have

been strongly and almost unanimously in favor of the application to land as in every respect the best and most advisable mode of treating sewage, *when circumstances will admit of its use.*" (*Royal Commission on Metropolitan Sewage Discharge, 2d Report, 1885*, pp. xxxviii., xxxix., xl.)

SOME INSTANCES OF SUCCESSFUL IRRIGATION.

Cheltenham. — "Population about 45,000. . . . Volume of sewage every twenty-four hours, 1,250,000 gallons. . . . Before irrigation was adopted, proceedings were threatened; . . . and in 1870 they purchased a farm of 131 acres. . . . No complaint has ever been substantiated since the adoption of irrigation; and there is not now, even in hot summer weather, any nuisance caused by the effluent from the sewage-farm" (pp. 11, 12.)

Doncaster. — "Population about 20,000. . . . Volume of sewage about 600,000 gallons per day. . . . The sewerage-works were completed in 1870, . . . and the sewage then flowed by an existing outlet into the river Don navigation. The proprietors of that navigation, in the autumn of 1870, filed a bill of complaint in chancery, and obtained an injunction. The corporation, as advised, not having a defence, consented thereto, asked for time to be given in which to carry out remedial works; and the court granted two years. The corporation then directed Mr. Brundell to examine and report on the best means of disposing of the sewage. This he did, and reported in favor of irrigation, advising that the sewage should be intercepted from the river, and pumped on to land, the property of the corporation at Long Sandall. Subsequently, the works, as designed, were carried out at a cost of £20,000. . . . The sewage-farm has now been in operation three years, no nuisance having arisen either at the pumping-station or on the farm" (pp. 14–16).

Leamington. — "Population 24,700. . . . Volume of sewage every 24 hours, upwards of (gallons) 800,000. . . . The offensive state of the river became gradually intensified by the impure sewage of the town flowing into it; and eventually, after repeated complaints by Lord Warwick, Mr. Richard Heath, and Mr. W. Field, riparian owners, Mr. Richard Heath, on the 25th November, 1864, filed a bill of complaint in the Court of Chancery, and on the 1st June, 1866, obtained an 'interim injunction' to restrain the local board from polluting the river Leam with the sewage of Leamington. The local authority did not satisfy the court that they were taking proper means to abate the nuisance; and an order of sequestration was, on the 2d August, 1867, issued, but

suspended from time to time. Subsequently, in 1868, the local board caused the bed of the river to be cleansed, and paid the costs of this work, amounting to £1,500, and also the costs of the suit, £5,000. About the same time Lord Warwick caused an offer to be made to the local board to take from them on lease for twenty-one years the sewage of Leamington, and pay £450 a year, provided it was delivered on to the Heathcote farms a distance of two miles from the town. The local board accepted the offer on the 5th April, 1870: and . . . these works were finished, and the pumping of the sewage to the 'Heatheote Farm' commenced on the 5th October, 1871; and the entire volume, except in heavy rainfall, has been pumped daily ever since that date. The soil of the farm is a fine loam on a subsoil of gravel: the flood-water flows by a storm outlet into the Leam." . . .

"The effluent water on the date of our visit to the farm, Aug. 18, 1875, was sufficiently purified to be admitted into the river, as not a trace of sewage could be detected in the clear and inodorous stream which flowed from the meadows into the water-courses" (pp. 19, 20).

Tunbridge Wells. — "Population (about) 23,000. . . . Volume of sewage every 24 hours (gallons) 650,000. . . .

"The sewage was formerly allowed to run direct into the Calverly Brook. On the 24th November, 1865, an injunction was obtained by Mr. Frederick David Goldsmid of Summer-hill Park, to restrain the Improvement Commissioners from polluting the 'brook:' and the latter having failed to satisfy the court that they had rendered the sewage inoffensive, an order of sequestration was subsequently granted; this order, however, was suspended from time to time, and finally discharged on 2d July, 1874, on the commissioners undertaking to intercept the sewage, and practically purify it before it flowed into the brook; to defray the expense of cleaning out the Summer-hill Lake, which amounted to £744 17*s.* 8*d.*; and also to pay the costs of the suit, about £3,000."

"To satisfy these conditions, the Improvement Commissioners caused intercepting sewers and outfall works to be constructed; and they also purchased two farms, one of 120 acres of stiff, loamy soil, one and a half mile to the north, and the other of 165 acres of light, open soil, three and a half miles to the south, of the town. These farms are prepared and laid out for irrigation: and the sewage, which is not treated by any chemical process, flows by gravitation through subsidence-tanks; and a daily volume of about 414,000 gallons is thus delivered on to an area of 118 acres at the South Farm, and about 236,000 gallons on to an area of 100 acres at the North Farm; the solid refuse is removed from the tanks when

necessary, and sold to farmers, who clean out the tanks, remove the deposited material, and pay £65 a year for it. The effluent water from the North Farm flows into the Calverly Brook, and that from the South Farm into the Brodwater Brook and the County Ditch, which are tributaries of the Medway. Samples of this water are collected every fortnight by the farm-bailiffs, and submitted to the Sewage Outfall Committee. No complaint has been made of the state of the effluent water since the removal of the order of sequestration" (pp. 26, 27. *Local Government Board. Report of a Committee . . . London, 1876, loc. cit.*).

FILTRATION THROUGH LAND.

"In speaking of broad irrigation, we have said that the purification is partly effected by the filtration of the sewage through the porous soil. This, however, is only an incidental action, depending on the character of the ground; and sometimes in heavy soils it may scarcely take place at all."

"We have also alluded to a novel system of sewage treatment, which was first proposed in the Rivers' Pollution Commissioners' Report of 1870 on the Mersey and Ribble Basins. This system consisted simply in making the filtration through porous land the *principal* instead of an incidental process of sewage treatment."

. . . "Dr. Frankland . . . instituted a series of experiments, and established the fact that by passing sewage through a suitable porous soil, not constantly but intermittently, a high degree of purification could be insured, the object of the intermittence being to *aerate* the filter, and so give an opportunity for the purifying action of the oxygen. It is explained that a filter so used is not a mere mechanical contrivance, but a chemical apparatus for oxidizing, and thus altogether transforming, as well as for separating, the filth of dirty water." . . .

"Filtration means the concentration of sewage, at short intervals, on an area of specially chosen porous ground, as *small* as will absorb and cleanse it; not excluding vegetation, but making the produce of secondary importance." . . .

"As to the *purity of the effluent*, the Rivers' Pollution Commissioners said, 'It would be difficult to decide between filtration and irrigation;' but there are some reasons why the filtration process would seem to have the advantage" (*Royal Commission on Met. Sewage Discharge, 2d Report, London, 1884*, pp. xliv.–xlvii.).

SOME EXAMPLES OF SUCCESSFUL FILTRATION THROUGH LAND.

Merthyr Tydfil. — Population, 50,000; adjacent districts, 50,000; total, 100,000. "On the 14th of June, 1884, Mr. Hasper, the local engineer and surveyor of Merthyr, in reply to an inquiry, obligingly informed the author that the quantity of land sewaged for the combined districts was 336 acres." . . . "In the same month the medical officer of the district wrote, saying, 'The Troedyrhiem areas do their work thoroughly.'"

Kendal. — "Mr. Banks (formerly borough surveyor), writing on the 26th August, 1884, says, 'I . . . think it one of the most successful schemes for dealing with sewage that there is in the country.'"

Abingdon. — "On the 27th May, 1884, the local surveyor wrote as follows: 'I have to state that the council thoroughly approve of the mode you adopted for the disposal of the sewage. We have not received at any time any complaint as to any local nuisance.'" . . .

Forfar. — "The manager, writing to the author in the early part of 1884, stated, . . . 'The farm is giving every satisfaction, and the effluent is always quite clear.' . . . . Mr. Alexander Campbell, inspecting officer to the Board of Supervision, Scotland, having visited the farm, publicly advised all sanitary authorities to pay it a visit, and judge for themselves."

Barnsley, Yorkshire. — "The manager writes on June 5, 1884, 'The farm is not yet paying its working expenses; but there are now no complaints whatever from adjoining landlords, nor any threats of a renewal of proceedings in the court of chancery.'"

Dewsbury, Yorkshire. — "A manufacturing town on the river Calder. . . . Population about 30,000. The farm-manager, on the 25th of May, 1884, wrote to the author, saying, 'The sewage-farm is doing better this season than before. . . . The sewage consists chiefly of dye-wash: nevertheless, the effluent is very good, and every one that sees it is surprised to see how clear it is. There are a great many mill-hands come to have a bath at the outlet, it being the only clear water for miles that they can bathe in" (*Deyton, J. Bailey. Ten Years' Experience* (*now fourteen years*) *in works of Intermittent Downward Filtration . . . London, 1885.* pp. 10–16).

PRECIPITATION.

"A chemical precipitation process does two things: it effects improvement in the liquid flowing away, and it leaves behind a precipitated deposit which has to be disposed of" (p. 1).

"Precipitating processes, though the same in principle as that of thirty years ago, have been greatly improved in detail, and, when well worked, are effectual where the quantity of sewage is not very great, where the sewage can be promptly treated, and where there is a running stream, into which the effluent can be discharged in a proportion not exceeding five per cent of the supply of fresh water" (p. liii.).

Mr. Melliss "considers . . . the clarified water would be quite pure enough to discharge into the Thames."

"It is not a pure water, but he does not suppose that a pure water is necessary."

"The effect of this treatment would be to deprive the sewage of the whole of the polluting matter in suspension, and one-half that in solution, rendering the effluent water sufficiently pure to be discharged into the Thames."

Mr. Sillar. — "He will not say that by the A. B. C. process the water is restored to its original purity: it is restored to a degree of purity which is unobjectionable."

Mr. Redgrave. — "In the case of towns situated on tidal rivers, where the volume of the river is large as compared with the amount of sewage to be dealt with, it is unnecessary to attempt to completely purify the sewage so as to make it chemically pure. All that is necessary is to remove the grosser suspended matters."

"The matter left in the effluent water would not cause a nuisance, considering the volume of water into which it would be discharged."

"Any dilution over a hundred times would suffice to render the effluent innocuous: any thing less would cause a nuisance."

Dr. Frankland. — "The effluent from chemical treatment is quite sufficiently pure to be mixed with the Thames water at the two outfalls at the present moment; but, when the population draining to these outfalls increases, he does not think it would then be sufficient to prevent the pollution of the river. He thinks the treatment by chemicals would be only a temporary measure. The sewage would increase, but the quantity of pure river-water would decrease" (p. lii.).

Mr. Mansergh. — "He has no fear of the constant discharge of the effluent water at all, if it is discharged clear."

"He thinks fish would live in the effluent."

Alderman Avery. — "Precipitation alone is not a satisfactory process: the effluent requires afterwards to be filtered through land" (p. liii. *Royal Com. on Met. Sew. Disch. 2nd Rept. loc. cit.*).

SOME EXAMPLES OF SUCCESSFUL PRECIPITATION.

Aylesbury. — A. B. C. process. "The Local Board of Health for the District of Aylesbury hereby express their entire satisfaction with the continued sanitary success of the native Guano Company's A. B. C. process, which has for the past five years been employed for the treatment of the sewage of the district; and they have much pleasure in confirming their certificate of the 23d July, 1880."

"That the effluent water was, and still continues, in a sufficiently purified state to flow into any river, as shown by the chemical analyses of Professor Wanklyn and others.

"That there has been no complaint of any kind, and that the whole operations are carried on without the slightest nuisance to the neighborhood."

"Dated this 21st day of October, 1881."

Seal of the
Local Board of Health
of Aylesbury.

Hertford. — "In 1883 the Conservancy Board of this river (river Lea) brought an action against the Corporation of Hertford for polluting the river by their sewage. The Corporation were bound by Act of Parliament to purify their sewage by 'the best known practicable process;' and after some changes, they had lately adopted a chemical process, effected by mixing the sewage with solutions of sulphate of alumina, sulphate of iron, and lime. The plaintiffs contended that the Corporation had allowed untreated and imperfectly treated sewage and other injurious matter to pass into and pollute the river: this the defendants denied, contending that the sewage was thoroughly defæcated and clarified, and was substantially free from offensive and injurious matter."

"The trial, before the late Mr. Justice Williams, without a jury, came on in February, 1884, and lasted thirteen days: many experts were examined. . . . The judge exonerated the defendants on all points of the action, finding 'that they had treated the sewage, and were still treating it, thoroughly, according to the best practical process; and, moreover, that no real injury, pollution, or nuisance had been caused by the Corporation to the waters of the Lea" (*Roy. Com. on Met. Sew. Disch. 2nd Rept.* 1884, p. xxv.).

Coventry. — "At the time of my visit, the statements as to the inoffensive character of the process were quite borne out by the evidence of my own senses. The only unpleasant odor noticeable arose from the lifting-shaft of the underground sludge-chambers, and this in its immediate vicinity. One of the filter-beds, which had just been left to rest, and might have been expected to exhale unpleasant effluvia, if secondary fermentation occurred, was perfectly sweet."

"The result of the chemical treatment appears to be the production of a neutral effluent water, in which the organic matter which still remains does not rapidly undergo putrefactive change. All of the samples of affluent waters, both off the tanks and off the filter-beds, which I have obtained, are, at the present date, still unchanged. I have tried to infect some of these with putrefactive ferments, with negative results" (Dr. Bushell Anningson, *Report on the Treatment of Sewage at Coventry*, *London*, *1882*, p. 7).

Leeds. — "Since this time the Corporation have had no experiments, and the precipitant used has been lime only. . . . The effluent is most satisfactory, the discoloration from dye being only periodical, and then very slight."

Petition of nearly One Thousand Women to the General Court, in the matter of the pollution of the Blackstone River.

The undersigned, resident women of the Town of Millbury, respectfully set forth their grievance on account of the pollution of the Blackstone River, showing —

That their health is impaired and their comfort abridged;

That they are subjected to the discomfort of nauseating odors constantly filling the air and surrounding their homes;

That they cannot, during the oppressive heat of summer, enjoy the cool evening air, either within doors or without, but are obliged to remain with doors and windows closed in order to exclude the foul and sickening odors;

That, during the heat of the day, the fetid air arising from the river, thick and sluggish with the offal of a city of 70,000 people, becomes an almost intolerable burden, creating nausea and weakness;

That it is impossible for them to visit the graves of their dead without encountering an overpowering stench from the polluted waters by which the cemetery is surrounded;

That, in passing along the streets and valley roads, there are localities where it is necessary to suspend the breath until a more favorable point is reached;

That the water of the Blackstone River has become utterly unfit for all domestic purposes, while formerly it was put to many uses by residents on the bank of the river.

Your petitioners, therefore, earnestly pray you to enact such measures as shall be for their immediate relief.

JOSEPHINE GODDARD,

And nearly 1,000 Others.

GEO. E. WARING, JUN.,

M. Inst. C. E.,

CONSULTING ENGINEER FOR SANITARY AND AGRICULTURAL DRAINAGE.

NEWPORT, R.I., May 4, 1886.

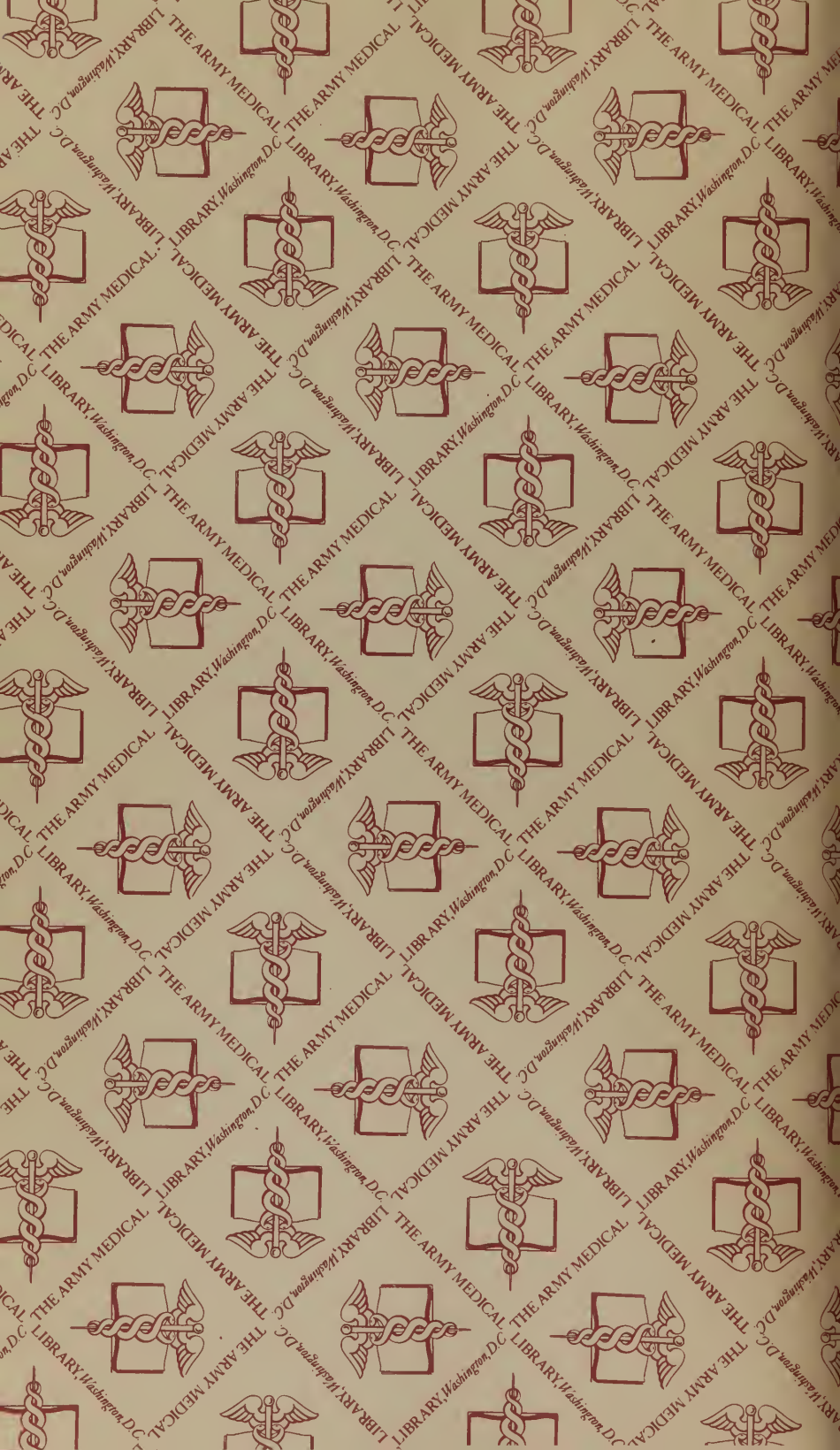
C. D. MORSE, ESQ.

Dear Sir, — I see no reason to suppose that the system recommended for the Worcester sewerage by the Massachusetts commission would not be satisfactory. As the sewage would have to be pumped, it would probably be pumped high enough to reach a considerable amount of land by broad irrigation, which I think, on the whole, is better than "intermittent filtration" where conditions are favorable for it.

The only reason why I prefer the plan that I recommended is, that, while I think it would be quite as effective as the other, it would cost very much less. Either method would undoubtedly relieve your people of their annoyance by purifying the sewage of Worcester.

Very truly yours,

GEO. E. WARING, JUN.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